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Not Under Our Back Yards? A case study of social acceptance of the Northern Netherlands CCS initiative

Herman W.A. van Os [a,*], Rien Herber [a], Bert Scholtens [b]

[a] University of Groningen, Faculty of Mathematics and Natural Sciences, Geo-Energy, PO Box 800, 9700 AV, Groningen, The Netherlands
[b] University of Groningen, Faculty of Economics and Business, Energy and Sustainability Centre, PO Box 800, 9700 AV, Groningen, The Netherlands

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ABSTRACT

We analyze the decision-making process of the abandonment of a Carbon Capture Storage (CCS) initiative in the Northern-Netherlands. We investigate the social acceptance of the Northern-Netherlands CCS initiative using the results from a survey among the key stakeholders. We find that local opposition can only be held partially responsible for the abandonment of the CCS project. This result differs from the broadly accepted notion "no local public acceptance, no CCS". Our study finds that the views from key stakeholders regarding the prospects of the CCS initiative were conflicting and this played a role in abandoning the initiative. We conclude that the way in which responsibilities between key stakeholders were arranged has had a dominant impact on the level of acceptance. We recommend that future policy and policy instruments for subsurface activities, like CCS, should be designed in accordance with the object, subject and inter-subject dimension of the decision-making process. In addition there should be a strategic framework, which accounts for the interaction between social-political, market and community acceptance.

Contents

* Corresponding author. Tel.: +31 50 3639 476.
E-mail addresses: h.w.a.van.os@rug.nl (H.W.A. van Os), Rien.Herber@rug.nl (R. Herber), l.j.r.scholtens@rug.nl (B. Scholtens).

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1. Introduction

In the spring of 2011 the Dutch government announced the abandonment of two Carbon Capture and Storage (CCS) initiatives: the Barendrecht CCS-project and the Northern Netherlands CCS initiative. In both cases the reason was said to be lack of local support [1]. Social acceptance also plays an important role in other planned subsurface activities in the Netherlands, such as the Underground Gas Storage (UGS) facilities in Pieterburen and Bergermeer [2,3]. The same phenomenon has been witnessed in Germany, the US, and Denmark [4–6]. As such, it appears that the local community may bring about the delay or even the premature (i.e. before a final decision from state or court has been made) closure of such projects. The experience with CCS projects in the Netherlands seems to suggest that the common decision-making process for subsurface activities fails to meet basic requirements for gaining social acceptance, such as the need for comprehensiveness, transparency and participation [7].

The foundation of decision-making processes consists of three dimensions: the object dimension (*what*?), the inter-subjective dimension (*who*?) and the subject dimension (*how*?) [8]. In this paper, we engage in a multi-focus analysis of these three dimensions in order to provide an answer to the question: *Why did the Northern Netherlands CCS initiative fail*? We will use a broad definition of social acceptance and put it in the wider context of Dutch decision-making for subsurface activities. Furthermore, we will present a framework to organize and analyze these dimensions in a systematic way. We performed a survey among the stakeholders in order to determine, what is called by Hage [9], *the trajectory of the decision making process*. As such, we contribute to the literature in the following ways: firstly, we provide an integrated framework regarding the social acceptance of subsurface activities. Secondly, we propose a novel approach to account for the views and opinions of key stakeholders in subsurface activities. In this way we analyze all three dimensions of decision-making processes surrounding CCS projects in an integrated way, which to the best our knowledge has not been done before.

The structure of this paper is as follows. In the next section, we first provide the general background of the case: CCS in the Northern Netherlands. Then we will discuss social acceptance from a broad perspective in section three. In section four, we describe our research method. In section five, we elaborate on the CCS initiative's social acceptance. We also discuss the results from our survey regarding the social acceptance of the CCS initiative. In the final section, we present our conclusions and provide recommendations and suggestions for future research.

2. Background

2.1. CCS in the Northern Netherlands

Dutch industrial production is very energy intense and electricity production is mainly the result of natural gas combustion [10]. This is due to the relative abundance of natural gas in the Netherlands. Coal fired power plants rank second in the electricity supply but no such plant has been built in the Netherlands in the last eighteen years [11]. The existing coal fired power plants will remain in production at least until 2021, because most of them have been retrofitted to extend their operational life. Three new coal-powered plants are currently under construction [12]. This has been framed as part of the energy supply security policy and CO_2 emissions reductions policies in the Netherlands to aim for fuel diversification [10].

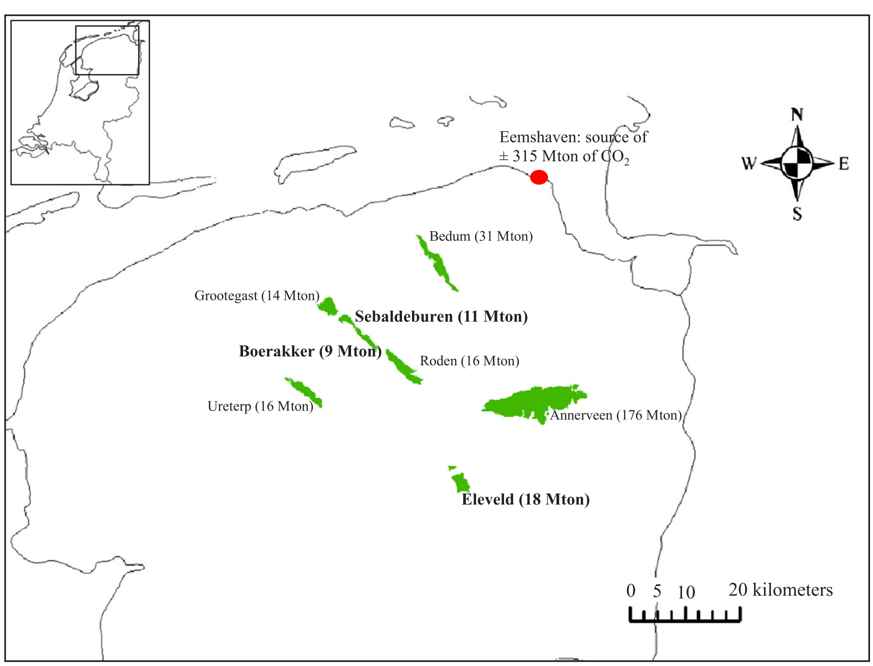


Fig. 1. Overview of the Northern-Netherlands CCS initiative with the CO_2 source in the Eemshaven and the selected gas fields, including the theoretical storage capacity. The fields in bold where selected for further investigation [17].

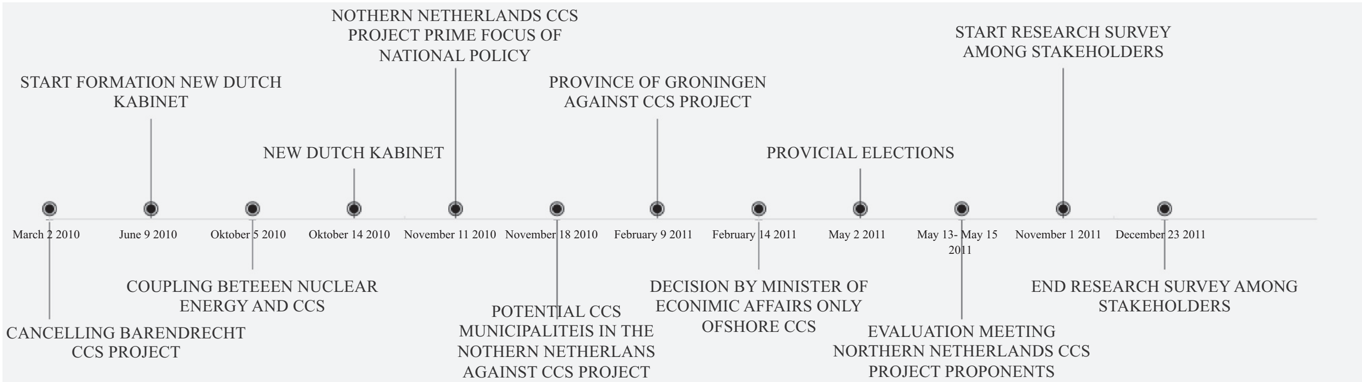


Fig. 2. Chronological overview of relevant events concerning the Northern Netherlands CCS initiative.

Parallel with the construction of new power plants, the Dutch national government planned several CCS projects as part of its policy to achieve a 20% reduction of Dutch CO_2 emissions in 2020, in line with the EU's 20-20-20 strategy [13]. To this extent, the national and regional governments signed the Northern-Netherlands energy covenant (in Dutch: Energie Akkoord Noord-Nederland), which included two directives for CCS [13]. First, the inclusion of the "capture ready criteria" in the environmental permit for two new power plants in the Eemshaven area [14,15]. Secondly, the power plant operators had to investigate the possibility of implementing a full CCS chain in the Northern-Netherlands with the two power plants as the source of the CO_2 [11,12]. The ambition was to store 2.6 Mt of CO_2 by 2013 and to increase this amount to 12.2 Mt in 2023 [13]. In an early stage of the Northern-Netherlands CCS initiative, the national government selected eight nearly depleted natural gas fields to investigate their suitability for CO_2 storage. Following a geological reconnaissance study, the number of fields was reduced to three for a more detailed investigation: the Boerakker, Eleveld and Sebaldeburen gas fields [16], all located less than 60 km from the projected power plants in the Eemshaven area (see Fig. 1).

Together, these three gas fields could provide 38 Mt of storage capacity. This is well below the 315 Mt of CO_2 that would have to be captured during the production life (40 years) of the power plants [13]; even the total capacity of the eight proposed gas fields, 291 Mt, would not be sufficient to store all CO_2 captured from the coal-fired power plants [13,18,19]. Furthermore, when applying some "real life" criteria, such as the maximum allowable pressure in the gas field or avoidance of old and unsafe wells, the storage capacity for the Northern-Netherlands CCS initiative would be substantially reduced [19].

The CCS project in the Northern Netherlands was regarded as a "demonstration" project to get acquainted with the technology, scale and acceptance of such storage projects [13]. At the outset of the project, people living in the area felt a high sense of injustice with regard to the decision-making process surrounding the CCS initiative [20]. A survey showed that 71% of the respondents thought that the CCS project would go ahead even without local support [20]. However, the previous cancellation of the (much smaller) Barendrecht CCS project in the West of the Netherlands had a direct effect on the collective efficacy of the opponents for the CCS initiative in the North, because it had created a precedent for subsurface activities: no project without local support. The Barendrecht project opponents proclaimed victory, which was in turn used by the opponents of the Northern-Netherlands CCS initiative to enforce their own cause [21]. Moreover, after the decision of the national government to halt the Barendrecht project, the minister of Economic Affairs, Agriculture and Innovation stated the following: *The government decided to stop with the Barendrecht CCS project because of a lack of local support. Therefore we will now explore the possibilities of realizing a CCS project in the Northern-Netherlands* [22]. This quote (our emphasis added) fueled the already existing feeling among several people in the area that their region is being exploited for the benefit of the western ("Holland") part of the Netherlands [16].

The opinion leaders opposing the Northern-Netherlands CCS project were members of local political parties [21] and other community organizations. Mannarini [23] views community organizations as an important way of involving the general public in the protest movement. The proponents on the other hand were mostly outsiders; our survey shows that they were hardly involved in local communities. In addition, media attention from local and national media strengthened the perception of a large movement against the CCS initiative [24]. Another relevant issue was the unexpected change in position of the national government in 2010. Unlike before, they now stated that any decision regarding CCS would only take place after a decision had been taken about the construction of a second Dutch nuclear power plant. By linking CCS with nuclear energy, the environmental groups, which were until that moment cooperating with the proponents of the Northern-Netherlands CCS project, decided that they no longer could be in favor of the project [24]. Leading up to the provincial election the minister of Economic Affairs, Agriculture and Innovation decided that CCS in the Netherlands was only allowed when situated offshore. This decision marked the end of the Northern-Netherlands CCS initiative (see Fig. 2).

This suggests that social acceptance can play an important role in the policy decisions of the Dutch government indeed. However, the discussion surrounding the Northern Netherlands CCS initiative also suggests that the current decision-making process is not capable to deal adequately with social acceptance because is not able to deliver a satisfactory result for all parties involved. Some researchers have recommended improvements, such as participation and risk communication [25,26]. However, these are mainly rooted in a single perspective (object, subject, or inter-subjective only). Moreover, social acceptance results from the interaction between all three categories of social acceptance [27]. We therefore argue that a multi-focus analysis of the object, subject and inter-subjective dimensions for each category of social acceptance of the Northern-Netherlands CCS initiative decision-making process may provide us with a better understanding of social acceptance of CCS projects.

3. Social acceptance

Social acceptance, in general for energy related projects and more specific for CCS projects, is gaining importance in practice.

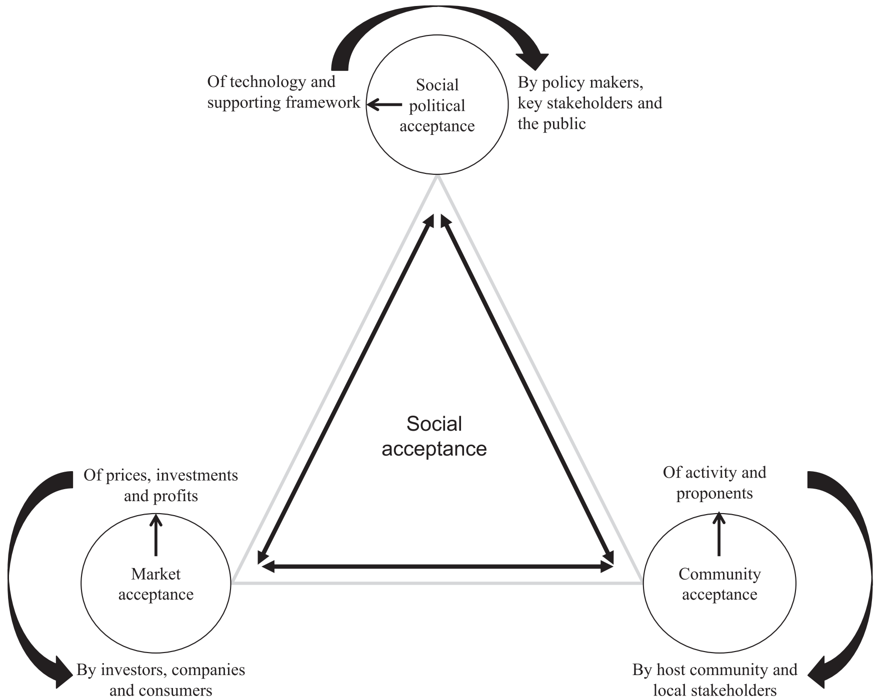


Fig. 3. The triangle of social acceptance [27].

However, literature does not provide an overall encompassing approach regarding social acceptance. Several case studies investigate general public acceptance and communication from a perspective that can be summed up in the question *What is the best practice for involving the local public in order to accept a project*? [28–31]. Others, like Sheng [8], primarily focus on the financial perspective, whereas a third group, like Atsushi and Langhelle [9], only relates to the political perspective. We argue that the different perspectives on social acceptance are helpful but in practice the different elements occur simultaneously and they can interact. Therefore we suggest an integrated approach that accounts for all perspectives.

The decision-making process in general is a culmination of a series of smaller decisions [8]. In order to analyze these smaller decisions we need a framework to define and structure the decisions [32]. In this respect, we will rely on the "triangle of social acceptance", which divides social acceptance in three categories, see Fig. 3 [27]. Hence, social acceptance encompasses social-political acceptance, market acceptance as well as community acceptance.

Social-political acceptance relates to the views and interests from institutions, like policy makers, concerning the potential of CCS as an innovative technology. According to [33] *Institutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanction, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, property rights and legislation)*. Market acceptance relates to the views and interests from private industry, like exploration and production companies. This especially concerns the strategic issues related to the investments in CCS. Here, the focus is on the characteristics of the project and the financial opportunities it provides for these companies. Community acceptance relates to the views and interests of residents, local authorities and other local stakeholders. For example, this concerns the siting issues of CCS.

We want to point out that there may be a problem with unambiguously defining the categories of social acceptance. For example, in our case, the Dutch government has multiple roles: The government is project co-initiator, as it issued the tender for the Barendrecht CCS project, project co-owner through the state-owned companies, as well as regulating authority through the Inspection of State Supervision of Mines. Therefore we will analyze the role of the government congruent with each category of social acceptance.

3.1. Social-political acceptance

The realization potential of CCS is determined by the degree to which it complies with the dominant discourses formulated within the social, cultural and political institutions [34]. In addition, opportunities to implement innovative technologies, like CCS, can vary if the dominant discourse and its accompanying vested interest are de-stabilised by higher order developments such as climate change [35]. Similar factors were also used to determine the level of support for CCS from a policy point of view [36,37]. Therefore we will discuss these institutions in order to gain an understanding of the factors relevant for the social-political acceptance of the Northern-Netherlands CCS initiative.

CCS has gained much attention from political institutions as a mitigation option for climate change [38] and several CCS projects are being planned and executed worldwide [39]. This was also the case in the Netherlands in the period 2005–2010, when the national government and the Northern provinces had ambitious plans regarding CCS. But after the Dutch national (2010) and provincial (2011) elections, the political view on CCS changed significantly: The newly elected national government favoured nuclear energy over CCS as a cost effective way to comply with policy goals, like CO_2 emissions reduction [10]. Furthermore, the policy goals formulated in the Dutch National Energy Program [10] also advocate alternative competing uses for the depleted gas fields, such as Underground Gas Storage (UGS).

The overall public perception of CCS in the Netherlands was found to be slightly positive in 2003 [40]. However, since then several new developments have shaped the public debate on CCS. The debate about the need and necessity of CCS reached a peak in the Netherlands during the summer of 2010 [41]. The debate was related to climate change, safety hazards, energy security, energy

policy, economic growth, environmental concerns as well as ethical issues [41]. The cancellation of the demonstration project seems to have ended the debate about CCS before a final conclusion about the necessity of CCS was reached.

Paukovic et al. [42] found that safety concerns related to CO_2 storage were the primary factor for the Dutch public in forming an opinion about CCS. Huijts [43] suggests that geographical proximity to a CCS project has a negative effect on the attitude towards CCS. They also found that the risks associated with CCS have a profound influence on the overall appraisal. Similar observations were made by Kuijper [44]. The Dutch government depicted CCS as a technology that bridges the gap between a society based on fossil fuels and one based on renewable energy [10]. In contrast, Greenpeace suggested that CCS would result in the prolonged use of fossil fuel [45]. Furthermore, Greenpeace suggested that the coal power plants, which will produce the CO_2 to be stored underground, were not required to satisfy Dutch energy needs but would be used to export the electricity produced [45]. This broadened the discussion about the need and necessity of CCS. The same happened in the Barendrecht CCS project, although less visible [44].

The formal cultural institutions, such as the planning regulations and procedures can be described as top-down oriented [46]. This is also visible from the selection of the storage location for the Northern-Netherlands CCS project where the national government unilaterally decided which locations would be suitable. Also in the Barendrecht CCS project, the national government was involved in the selection of gas fields via a tender [26,44]. This is in line with the role of the national government as laid down in the Mining Act, which governs all subsurface activities in the Netherlands. It holds that the minister of Economic Affairs is accountable and that lower tiers of government and local residents have limited or no influence [47]. Both form the Barendrecht en Northern-Netherlands CCS case it is clear that the informal cultural institutions carry a different perspective on the selection process. The procedure was seen as unfair and lacking transparency resulting in a negative attitude among citizens in the host communities [21,26].

3.2. Market acceptance

In the context of CCS, private companies have different business models i.e. each of these companies has a different ambition and position regarding the opportunities of CCS, rendering the market fragmented. This is important to realize when analyzing the role of these market parties [48]. Bowen [49] defines four strategic elements, which are instrumental to the investment opportunity of CCS for market parties. The first element is the precautionary motive, related to the drive to act now in order to mitigate possible future negative effects [49]. Second, investment will have an impact on the company's business strategy and its strategic options. Thirdly, early CCS investments will influence later investments, because CCS is an emerging technology. Fourthly, the success of the investment will depend on the economic, legal and social framework, which is case-specific. In this respect, alternative uses of the underground (like storage of nuclear waste, mining, water supply, gas storage, etc.) have to be accounted for as competing investment options. The learning effects may be limited because of the case specific nature of knowledge [49]. We will discuss these strategic elements in the following paragraphs.

The Dutch government not only acts as the regulator, but it also is one of the main market parties via its 100% ownership of Energy Administration Netherlands (in Dutch: Energie Beheer Nederland), the company which participates in the exploration and production of the Dutch gas fields and Gasunie which is responsible for gas transport. Although these companies operate independently and influence the energy discourse in their own ways, they follow the policy set by the national government. Therefore we exclude these state owned companies and concentrate on the privately owned parties, namely NAM exploration and production (E&P) company (joint venture between Shell and Exxonmobil), and the power companies (RWE and NUON).

The power companies are subject to the European Union Emission Trading Scheme (EU-ETS) and therefore need to decrease their CO_2 emissions in the coming years, for example by investing in low carbon technologies. These investments are relatively expensive and in a market with small profit margins this can have a profound effect on overall profitability [50]. Power companies therefore search for a cost effective way to comply with regulations to ensure the continuity of their business. CCS has the potential to provide a business model that complies with the low carbon emissions and energy supply policies formulated by national governments and the EU. Power companies can also switch from coal to gas or invest in renewable energy sources.

The E&P companies have to make do with the fact that the Dutch gas reserves will be depleted sometime in the second half of the 21st century [51]. Therefore they try to find new business opportunities for the continuity of their companies. CCS is being portrayed by some parties as having the potential to provide a new profitable business model for the E&P companies in the Netherlands [48]. However, CCS may conflict with other business opportunities, like geo-thermal energy, enhanced production of hydrocarbons or Underground Gas Storage. As such, CCS has limited potential to assure the continuity of the companies involved. They have to decide whether or not to invest in CCS as part of their business model. Only in case this earns a positive net present value, the investment is deemed feasible. With the low CO_2 prices during the last years, this is not the case.

The main difference between power companies and E&P companies is that power companies need to invest in CCS as an intrinsic part of their business model since they are the owner of the CO_2. For E&P companies, it is just one of several options for exploiting their subsurface assets. In addition, CCS has a higher likelihood to interfere with other E&P activities, like natural gas production than it will have with alternatives for power companies to reduce CO_2 emissions, like wind and solar energy.

Although there is a slight difference between the two (foreign owned) power companies, they both sustain the centralized way of energy production, by investing in CCS. Moreover, they have the ownership of the CO_2. Furthermore, CCS investments by the E&P companies can be described as a disruptive investment because the sequestration of CO_2 in a depleted gas field can conflict with the production of hydrocarbons [52]. A depleted gas field will always retain some residual amount of gas and injecting CO_2 can thus result in a loss of natural gas from an economic point of view [38,53]. This loss of natural gas conflicts with the goal of the E&P companies, namely to extract hydrocarbons from the subsurface. In contrast with the power companies, the E&P companies do not own the CO_2.

The cost of CCS and the price of EU-ETS certificates are the main drivers of the commercial viability of CCS [54]. According to McKinsey [54], the current CCS cost, ranging between € 50 and 70/t of CO_2, might decrease. This will depend on several uncertain factors, like learning and implementation rates [55]. Furthermore, there are several uncertainties surrounding the price of ETS certificates. For example, the current (09-09-2013) price of the EU-ETS credits is € 5.39/t of CO_2 [56] which is well below the cost of CCS. By building power plants which are only "capture ready", the cost of capturing CO_2 will most probably be higher than for a power plant with capture capabilities from the start [38]. Therefore the cumulative effect of delaying CCS demonstration projects postpones the large-scale roll out of CCS, making it harder to realize because of the higher expected costs [55].

The cumulative cost effect of CCS, both in the form of upfront investments as well as through tariffs in the operational phase, is

closely related to the selection of gas fields. Gas fields differ in terms of size and geological characteristics, hence the cost of storage for a CCS project will differ for each field [38]. The selection of a gas field will, amongst other factors, be based on the amount of CO_2 expected to be stored. When there is uncertainty about this capacity, a small gas field or cluster will most probably be selected, as was the case for the Barendrecht CCS project. There are two reasons for selecting a small gas field. The first reason is the fact that a depleted gas field always retains a small percentage of residual natural gas. In absolute terms therefore, in a small field a lower amount of gas is lost than in a large field. Secondly, a small gas field would allow a complete run-through of all the phases of a CCS project (drilling, injection and abandonment) in a relatively short time span, thus reducing the risks and costs of the full project. On the other hand, the selection of a small gas field can result in higher unit storage costs. This is the case when the available amount of CO_2 is larger than expected and more installations have to be built at different gas fields.

Most of the CCS projects are also meant to improve the know-how concerning the implementation and scaling up of CCS [13,57,58]. The companies involved find that knowledge gaps concerning CCS are primarily related to the more situated knowledge [48]. This raises the question how responsibilities between the different parties are arranged and how the costs and benefits are distributed. The answer is case-specific [49]. Therefore the transferable knowledge will most probably be limited to CO_2 capture technology and CO_2 injection technology, which have a much lower context dependency. This knowledge has to be shared with the scientific community because of subsidy terms and conditions [59]. In conclusion, the knowledge concerning technology, like capture, is transferable but not very likely to provide a significant market advantage for early CCS adopters [49].

3.3. Community acceptance

Infrastructural investments tend to invoke protests from nearby residents [60]. This is also the case for activities in the subsurface [3,21]. The experiences with wind energy may act as guideline for analyzing community acceptance of CCS. Here, Wolsink [61] identifies four factors that may contribute to the level of community acceptance: the attitude regarding the technology, the proximity of the project, the perceived level of fairness of the decision-making process, and the visual impact on the landscape. In addition, Wüstenhagen et al. [27] identify a fifth factor, namely the appraisal of the project proponent by the host community.

The results from a survey in 2011 seem to support a Not In My Back Yard (NIMBY) like effect for CCS [43]. The term NIMBY can refer to many forms of opposition to *Locally Unwanted Land Uses* (LULU) [62]. In general, two elements can be identified: a positive view at the global level and a negative view at the local level [62]. In case of CCS, it appears that at the local level the views are negative indeed [18], whereas the positive view at a more general level is lacking [20,40,63]. This would imply that NIMBY is not a complete or valid explanation for the developments surrounding the Northern-Netherlands CCS initiative, because a positive attitude at the general level is lacking. At the same time, there is very little evidence of a NIMBY effect related to the exploitation of gas fields in the Netherlands [44]. Thus despite the similarities between CCS and natural gas recovery, like impact and risks, there is a marked difference regarding community acceptance.

Kuijper [44] suggests that the lack of regulations for CCS projects is one of the reasons for this difference, especially regarding the perceived level of risk. Devine-Wright [64] found that NIMBY does not provide a good explanation for developments, which were observed in the siting of LULU's. He proposes “place protective action”, where local opposition is seen as the result of a process where LULU developments influence the emotional attachments and personal identity of an individual [64]. In addition, Sherif [65] states that the more a person is or feels affected by a project, the greater the chances that this person will have a negative attitude. This is especially the case when the project will affect the person's core values like personal safety or the value of her or his real estate [65]. A possible remedy could be the inclusion of local stakeholders in the early stages of the project in order to reduce the “shock effect” and the resulting defensive attitude [66].

The impact of a CCS project on the landscape relates to the need for a facility to inject the CO_2 [67]. The size and the impact on the landscape are of the same order of magnitude as that of installations used for natural gas production [67]. Besides the impact, the location of the project is also relevant when assessing community acceptance. For example, Dütschke [4] indicates that a brownfield[1] development encounters less opposition than greenfield[2] development in case of two CCS projects in Germany. A possible explanation for this phenomenon is the emotional relationship between an individual and a location. If this is positive, the likelihood of a negative attitude towards a project is higher if it has an impact on the location and vice versa [68]. However, this will have a limited effect in the Netherlands because CO_2 will only be stored in depleted gas fields [52], i.e. brownfield developments.

The project proponent and its reputation also determine the level of community acceptance. ter Mors [69] found that nature conservation groups, when they were involved in the process, had a positive influence on the overall appreciation of the CCS project proponents. Furthermore, Daamen et al. [70] found that the host community has more confidence and trust in local stakeholders, like the municipality, than in stakeholders operating at the national level, like the national government. Including a wide variety of local organizations in the project organization could improve the level of trust and, thereby, the acceptance of the project [69].

4. Model and methodology

We will use the issues, as defined in section three, related to siting, innovation potential and the strategic issues [32,49,61] to assess the level of social acceptance. Some scholars have already researched the decision-making process surrounding CCS [71–73]. However, these studies did not indicate the difference between the dimensions of the decision-making process. Therefore for each category of social acceptance (i.e. social-political, market and community) we will investigate the three dimensions of the decision-making process, namely the inter-subject, the object and the subject dimension. The *inter-subject dimension* represents the hierarchical and participative nature of the decision-making process. In other words, the way in which collaboration and responsibility between stakeholders is arranged [8]. The *object dimension* consists of the physical and social reality of the activity to which the decision making process applies, i.e. which kind of topics need to be included in the decision-making process [8]. The *subject dimension* is related to the way in which decisions are supported. We will analyze the different levels and the nature of the three categories of social acceptance in order to determine

[1] Brownfield developments are meant here as the re-development of previous developed areas.

[2] Greenfield developments are meant here as the development of previous un-developed areas.

why the decision-making process failed in the case of the Northern-Netherlands CCS initiative. We engage in a case study of the Northern-Netherlands CCS initiative as we are interested in the different dimensions of the decision-making process. A case study serves our purpose best, as is evidenced by other studies which have opted for this approach too [4,26,40,44,70,74].

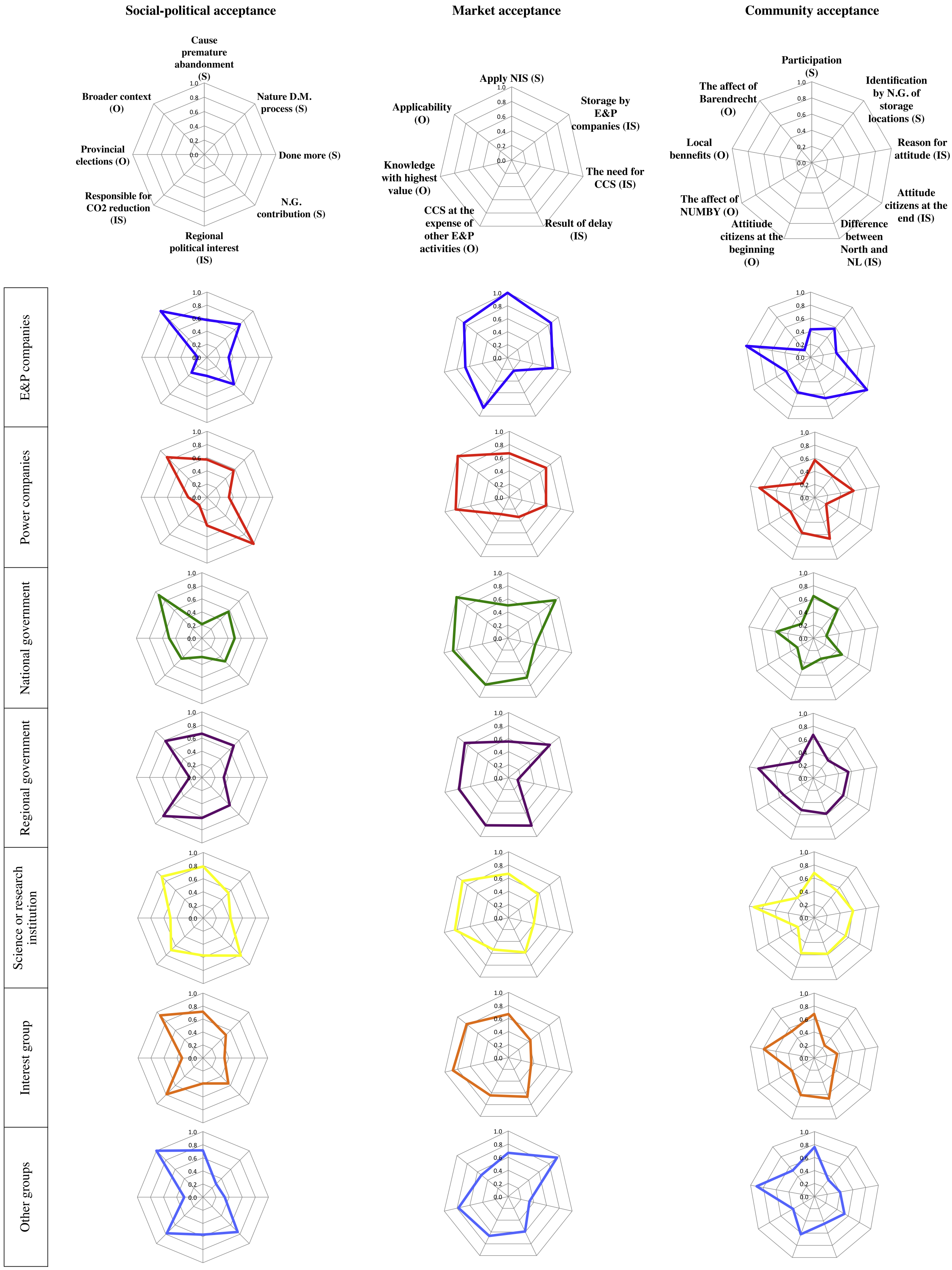


Fig. 4. Results of the survey, depicted as fractions based on the computation steps 1–3.

We conducted a survey among stakeholders in the Northern-Netherlands CCS initiative in order to gain an understanding of the role of social acceptance within the decision-making process [27]. The interviewees from the stakeholder groups were asked to give their opinion about the Northern-Netherlands CCS initiative and the corresponding decision-making process in both an open and a closed structure, in line with the approach used by Ribeiro et al. [75]. Following Shackley et al. [76], the survey questions were designed in accordance with insight gained during a three-day evaluation workshop in which the proponents of the CCS initiative reflected back on the decision-making process three months after the abandonment [60].[3]

Nine months after the abandonment of the Northern-Netherlands CCS the survey was e-mailed to 55 recipients, spread over the organizations and institutions involved in the CCS initiative, in the period between November 1st and December 23rd, 2011. Nineteen recipients participated, yielding a response rate of 34.5%, which is well above that in most other studies [68]. We also invited the main opponents group, called Co2ntramine, to participate in the survey but they declined (personal communication). Although the absolute number of interviewees is not very high, we are able to provide insight in the views of the stakeholders for three reasons:

(1) The total number of people involved in the Northern-Netherlands CCS initiative decision-making process is relatively small. We estimate it concerns around 60 people, divided over a relatively small group of organizations.
(2) As several interviewees indicated, their answers to the survey questions represent the views of their organizations.
(3) There is a wide range of organizations in our sample and it covers all major stakeholders.

The affiliations of the interviewees are given in Appendix A.

The Northern Netherlands CCS initiative involved the national government and three provinces. All four participated. Furthermore, three interest groups took part: the Energy Valley Foundation, the Borg Foundation and the Nature and Environment Federation. The first two represent the business community and are clearly in favor of storing CO_2 in the depleted gas fields in the Northern provinces, the latter represents non-governmental environmental organizations. The scientific and research institutions can be divided in two fields of research: the technical aspects of CCS, like geology (e.g. TNO, a consultancy and research organization) and the social aspects of CCS, like acceptance (e.g. University of Leiden). The other organizations consisted of temporary groups, like the Core Team CCS Northern-Netherlands, in which companies, provinces and the university Groningen cooperated. Their ambition was to identify and formulate conditions for a successful business case for CCS [13]. Finally, there were three commercial parties involved, the power companies RWE and NUON and the Dutch Oil Company (in Dutch; de Nederlandse Aardolie Maatschappij).

In order to relate the involved parties to our framework, we have divided the survey questions (see Appendix B), Here the corresponding categories of social acceptance are matched with the dimension of decision-making process and the corresponding survey questions.

By structuring the survey questions we are able to determine the trajectory of the decision-making process for each category of social acceptance. The trajectory is determined by the following computations:

1. Standardizing the score for each question to comply with the direction of the level of social acceptance.
2. Calculating the score of each organization for each question, on the basis of the insights discussed in section two on a Likert scale [77] for all closed question on a interval scale. In addition, calculated the score for all open questions on an ordinal scale.
3. Determining the fraction by dividing the score with the number of points on the Likert scale or the number of choice option, in order to compensate for higher number of choice options.
4. Aggregating the fractions for each stakeholder, by averaging the fractions for each dimension of the decision-making process and for each category of social acceptance.
5. Subtracting from the aggregated fractions the average of all fractions, in order to arrive at a common reference point that facilitates comparison.

Using fractions we avoid giving a weight to certain score simply because of a larger number of choice options and survey questions. Furthermore, using multiple questions we reduce the impact of any single question on the final score and gain a broader insight in the instrumental factors. However, the effect of a single score on the level of social acceptance is lost when aggregating the data. This is also true for our trajectory of the decision-making process where interval data is transformed into ordinal data, because our lowest measuring level is ordinal. In addition there may be some ambiguity when performing the above mentioned computations for ordinal scales [78]. Adams et al. [79] argues that: *Nothing is wrong* per se *in applying any statistical operation to measurements of given scale, but what may be wrong, depending on what is said about the results of these operations, is that the statement about them will be empirically meaningful or else that it is not scientifically debated*. Göb et al. [78] therefore states that the specific problem, the specific context, and the solution potential determine the adequacy of the data analysis methods. We will therefore use the non-aggregated data for discussing our conclusions and recommendations and we will only use the aggregated data for visualizing an overall view i.e. our trajectory of the decision-making process, in order to gain a broad insight in the decision-making process for the Northern-Netherlands CCS initiative.

5. Social acceptance and the decision making process

In this section we present the results of our survey in order to assess the decision-making process regarding the CCS initiative in the Northern-Netherlands.

5.1. Survey results

The results from our survey are depicted in Fig. 4. This figure shows that the stakeholders have different views surrounding the Northern-Netherlands CCS initiative. We use the three categories of social acceptance to discuss the results (in Appendix B an overview of the survey results is given). The three categories of social acceptance are depicted in the columns, the rows show the answers from the different stakeholders that took part in the survey. In the top of Fig. 4, three template spider graphs are depicted to show how each survey question is related to an axis. Furthermore, for each question it is indicated to which dimension of the decision-making it relates, trough the abbreviation (S) subject, (IS) inter-subjective and (O) object dimension.

5.1.1. Social-political acceptance

When comparing the views from stakeholders in the social-political acceptance category several results are interesting. The difference between the stakeholders concerning the nature of the decision-making process suggests that there is a gap between the

[3] The original survey was in Dutch, a copy can be ascertained by contacting the corresponding author.

more formal stakeholders (E&P, power companies, national and regional governments) and the more informal stakeholders (interest groups and the other groups). In addition, the formal stakeholders see the nature of the decision-making process more positive than those who were not directly involved.

The majority of the stakeholders regard the national government as the party that contributed the least to the success of the Northern-Netherlands CCS initiative. However, the national government itself, the E&P companies and the scientific and/or research institutions have more reservation in this aspect. Furthermore, the views concerning the influence of regional (political) interest on the Northern-Netherlands show that the E&P companies, the power companies, the national government and the interest groups believe that this influence is important. The other stakeholders believe it to be less relevant.

With respect to the responsibility for reducing CO_2 emissions, the market parties and national government believe this is a shared responsibility. However, the other stakeholders believe that CO_2 reduction is the sole responsibility of the power companies. In addition, all stakeholders agree that CCS projects need to be implemented in a broader societal context, namely that of global climate change.

Almost all stakeholders think that the cause of the premature abandonment is due to the lack of both a clear vision about the future and sound cooperation between the stakeholders. The national government is the exception; it assumes that the lack of perseverance among the stakeholders involved in the decision-making process is the main cause.

5.1.2. Market acceptance

The view on strategic issues for CCS regarding the business model of the organization shows a difference between national and regional governments. The former sees CCS as an essential technology, whereas the latter doubt this. Another interesting difference is found between the E&P companies and the power companies. The first sees more need for CCS, which is quite remarkable since they do not own the CO_2. In addition, the result of the abandonment of the Northern-Netherlands project seems to have divided the stakeholders. Especially, the E&P and power companies believe that this will have a substantial and negative effect on CCS in the Netherlands. Furthermore, all stakeholders feel the acquisition of knowledge with a higher context dependency is useful.

At the same time, however, the applicability of knowledge is related to the context dependency level. Therefore when comparing the two previous factors, it becomes clear that the national government overestimates the applicability of the knowledge gained. The other stakeholders demonstrate a good understanding of the limitations with respect to this applicability. Finally, almost all stakeholders think that the E&P companies should execute the storage part of CCS. Only the scientific or research institutions and interest groups are reserved in this regard.

5.1.3. Community acceptance

The E&P companies believe that the positive influence of participation from the host community on the success of the Northern-Netherlands CCS initiative is less relevant. In contrast, the other stakeholders believe that participation from the host community is beneficial. In addition, the effect of the Barendrecht CCS project on the Northern-Netherlands creates a similar distinction between the stakeholders. The E&P companies believe that (the failure of) the Barendrecht CCS project had a bigger influence on Northern-Netherlands CCS initiative than the other stakeholders do.

The differences in the attitude of citizens at the beginning of the project as perceived by the stakeholders shows that the governments believe that this attitude was relatively negative. This is an interesting observation because the national government and provinces, through the Northern Netherland energy covenant, were the initiators of the Northern-Netherlands CCS initiative. In addition, most stakeholders think that there should be more emphasis on local positive benefits in the decision-making process for CCS activities. However, the national government disagrees. Finally, most stakeholders with the exception of

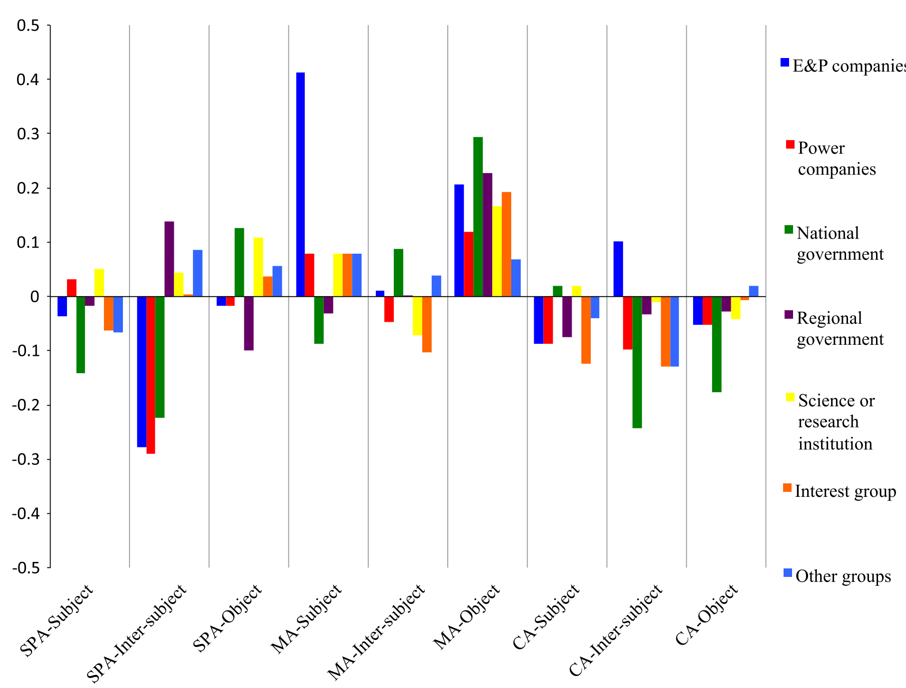


Fig. 5. Social acceptance in the decision-making process surrounding the Northern-Netherlands CCS initiative. On the horizontal axis the social-political acceptance (SPA), market acceptance (MA) and community acceptance (CA) are depicted including the three dimensions of the decision-making process. On the vertical axis a bar is depicted to indicate the acceptance level for each combination of social acceptance classes and dimensions of the decision-making process. The acceptance level is based on the averages for each class of social acceptance and dimension of the decision-making process, after being subtracted by the overall average (computation steps 1–5).

the power companies indicated that the unfamiliarity with CCS was the main reason for people's attitude towards CCS.

5.2. Trajectory of the decision-making process

Fig. 5 depicts the trajectory of the decision-making process for the Northern-Netherlands CCS initiative, based on the survey results and computation steps 1–5 described in Section 4. As can be observed, the acceptance level varies for each category of social acceptance and for each dimension of the decision-making process.

The lowest acceptance is found in the inter-subject dimension of social-political acceptance. Community acceptance also shows a low level of acceptance. Market acceptance is fragmented, especially regarding the subject dimension (applying the National Integration Scheme). The object dimension of market acceptance (knowledge and its applicability) shows the highest acceptance, a phenomenon also observed in other studies. For example, Bowen [49] argues that this is related to the somewhat naive claim that investments in CCS will lead to exportable domestic technologies and therefore to economic growth.

Fig. 6 gives the distribution of the fractions of shareholders for each category and dimension in the decision making process, based on the computation steps 1–5. This figure reveals that the low community acceptance seems to be the main reason for failure, especially according to the national government and the interest groups. In addition, the low level of social-political acceptance is seen as an additional reason why the Northern-Netherlands CCS initiative failed. This is especially true for the E&P companies, the power companies and the national government. Furthermore, most stakeholders experience market acceptance as positive. However, the subject dimension shows that not only the regional governments but also the national government is more reluctant in applying the National Integration Scheme, which is a top-down instrument that bypasses the lower tiers of governments in the decision-making process [80]. Finally, when comparing the three dimensions of the decision-making process, it is clear that the inter-subject dimension generally scores lowest for each category of social acceptance.

6. Conclusions and discussions

Social acceptance is gaining a more important role in the planning of subsurface activities in the Netherlands and other countries. It appears that local communities can have a decisive role in the decision-making process. From the recent process surrounding the Northern Netherlands CCS initiative, it seems that the current decision-making process for CCS fails to account for social acceptance as an important element of the decision-making process. This resulted in our research question: *Why did the Northern Netherlands CCS initiative fail*?

We identify the acceptance by each category of social acceptance as well as for the subject, inter-subject and object dimensions of the decision-making process on the basis of a survey among the main stakeholders. We conclude that limited

Table 1
Organizations involved in our survey.

You are connected to the CCS project, Northern-Netherlands for your work for	Frequency	Percentage	Valid percentage	Cumulative valid percentage
E&P companies	1	5.3	5.3	5.3
Energy companies	1	5.3	5.3	10.5
National government	2	10.5	10.5	21.1
Regional government	4	21.1	21.1	42.1
Scientific or research institution	4	21.1	21.1	63.2
Interest/lobby group	4	21.1	21.1	84.2
Other organizations	3	15.8	15.8	100.0
Total	19	100.0	100.0	

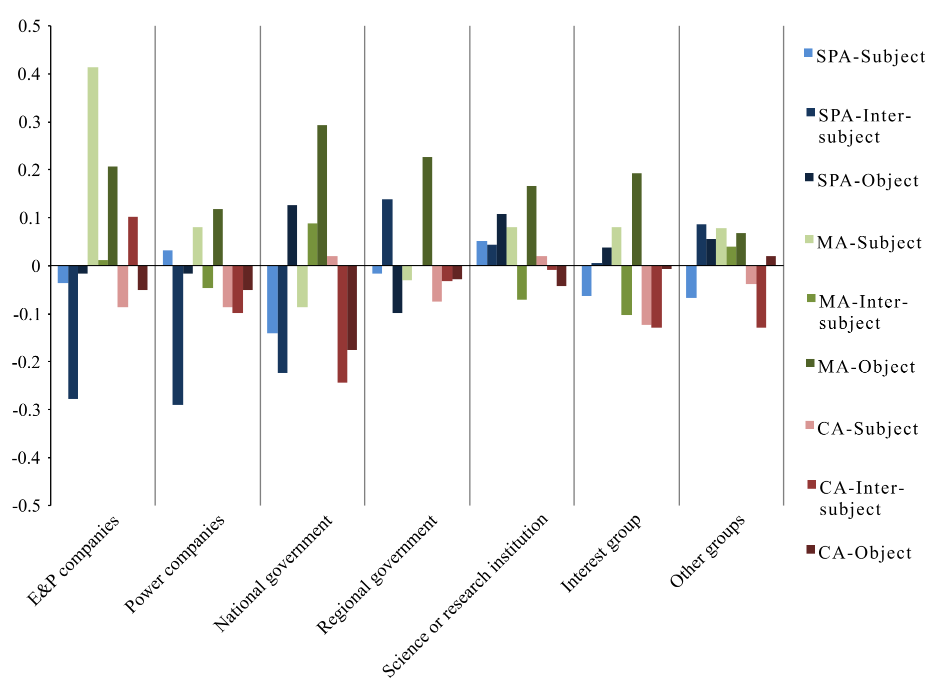


Fig. 6. The fractions of stakeholders for each category and dimension in the decision-making process. The bars represent the level and direction of the level of social acceptance. The blue shades represent the social-political acceptance, the green shades represent the market acceptance and the red shades represent the community acceptance. On the vertical axis a bar is depicted to indicate the acceptance level for each stakeholder. The acceptance level is based on the averages for each class of social acceptance and dimension of the decision-making process, after being subtracted by the overall average (computation steps 1–5).

Table 2
Distribution of job sectors among respondents.

Profession	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Something else	Total
Communication count	0	0	0	0	0	1	1	2
Decision-making count	0	1	2	3	1	1	1	9
Research count	1	0	0	1	3	2	1	8
Total count	1	1	2	4	4	4	3	19

Table 3
Involvement of respondents in host communities.

Personally active in the communities	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Something else	Total
Hardly count	0	0	2	1	3	1	3	10
Somewhat count	1	1	0	0	0	0	0	2
Reasonable count	0	0	0	1	1	0	0	2
Significantly count	0	0	0	1	0	1	0	2
Much count	0	0	0	0	0	1	0	1

Table 4
Results and metadata for question 14.

(14) The decision-making surrounding the CCS project in the Northern Netherlands can be described as	Scale question 14	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Dishonest	7						25%	
Top down	6				20%			
Political	5	100%		50%	40%	20%		
Badly timed	4		100%		40%	40%		
Unprofessional	3			50%		40%	25%	25%
Fragmented	2						50%	50%
Chaotic	1							25
	Score	5.00	4.00	4.00	4.80	3.80	3.50	2.00
	Fraction	0.71	0.57	0.57	0.69	0.54	0.50	0.29
Measuring scale	Ordinal scale							
Class	Social-political acceptance							
Dimension	Subject dimension							

Table 5
Results and metadata for question 11.

(11) The premature abandonment of the CCS project in the Northern Netherlands is	Scale question 11	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
An unfortunate combination of circumstances	7					50%		33%
A victory of local action groups	6				33%		33%	
Due to a lack of cooperation between the various parties	5						33%	33%
Due to lack of a clear vision	4	100%	100%		67%	50%	33%	
Missed opportunity	3							33%
Lack of perseverance	2			50%				
Political chose	1			50%				
	Score	4.00	4.00	1.50	4.67	5.50	5.00	5.00
	Fraction	0.57	0.57	0.21	0.67	0.79	0.71	0.71
Measuring scale	Ordinal scale							
Class	Social-political acceptance							
Dimension	Subject dimension							

community and social-political acceptance were the main reasons why the Northern-Netherlands CCS initiative failed to materialize. This is especially true for the inter-subject dimension, i.e. the way in which responsibility and interaction between stakeholders was arranged.

It can be concluded from our results concerning social-political acceptance that the lack of a clear and shared understanding about the need and necessity of CCS is the main reason why the acceptance level is low. Similar conclusions are found elsewhere in the literature, for example [37,81]. If governments in general and the Dutch government in particular want to be successful in establishing CCS projects, they should at least consider to reassess their support and commitment for CCS in a broader long term context, which includes energy, climate change and economy. This should be based on the actual, demonstrable distribution of costs and benefits through time and not solely on the basis of the rhetoric used by CCS proponents [49,82]. From our analysis of market acceptance, it can be concluded that there is a lack of common shared understanding about the responsibilities of each stakeholder. This is especially visible in the way possible gains from CCS are being perceived. For the Northern Netherlands CCS project, the national government seems to overestimate the benefits of CCS in comparison with the other stake-holders, especially those benefits that are related to more situated

Table 6
Results and metadata for question 12.

(12) Which party has in your opinion, contributed the worst to the decision making process for the CCS project Northern-Netherlands	Scale question 12	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
The national government	1	100%	100%	50%	100%	75%	100%	100%
The provinces	2			50%		25%		
The municipalities	3							
	Score	1.00	1.00	1.50	1.00	1.25	1.00	1.00
	Fraction	0.33	0.33	0.50	0.33	0.42	0.33	0.33
Measuring scale	Ordinal scale							
Class	Social-political acceptance							
Dimension	Subject dimension							

Table 7
Results and metadata for question 13.

(13) What should or could this parties have done more, according to you?	Scale question 13	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
More attention for local affairs	6	50%	100%			43%		
Giving the decision-making process more time	5					29%	33%	
Better cooperation	4			50%	60%	14%	33%	50%
More expertise and professionalism	3				40%			50%
Looking beyond their own political interests	2			50%		14%		
Continue with Barendrecht CCS project	1	50%					33%	
	Score	3.50	6.00	3.00	3.60	4.86	3.33	4.50
	Fraction	0.58	1.00	0.50	0.60	0.81	0.56	0.75
Measuring scale	Ordinal scale							
Class	Social-political acceptance							
Dimension	Subject dimension							

Table 8
Results and metadata for question 9.

(9) Which of the following parties is responsible for reducing CO_2 emissions	Scale question 9	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Power companies	6				33%	50%	25%	33%
Stable terms	5			16%	33%	16%	25%	
National government	4				33%		50%	67%
E&P companies	3			50%				
Public at large	2	100%						
Everybody	1		100%	34%		34%		
	Score	2.00	1.00	2.65	5.00	4.15	4.75	4.67
	Fraction	0.33	0.17	0.44	0.83	0.69	0.79	0.78
Measuring scale	Ordinal scale							
Class	Social-political acceptance							
Dimension	Inter-subjective dimension							

Table 9
Results and metadata for question 25.

(25) The early abandonment of the CCS project in the Northern Netherlands is the result of regional political interests	Scale question 25	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	1			50%				
Agree	2	100%			33%	25%	50%	
Partly agree	3		100%	50%		25%	25%	67%
Neutral	4						25%	
Partly disagree	5				33%	25%		
Disagree	6				33%	25%		33%
Completely disagree	7							
	Score	2.00	3.00	2.00	4.33	4.00	2.75	4.00
	Fraction	0.29	0.43	0.29	0.62	0.57	0.39	0.57
Measuring scale	Interval scale							
Class	Social-political acceptance							
Dimension	Inter-subjective dimension							

Table 10
Results and metadata for question 21.

(21) The events surrounding the provincial election in 2011, like the action by minister Verhagen, ushered in the definitive end of the CCS project Northern-Netherlands	Scale question 21	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	1	100%			67%		25%	33%
Agree	2		100%		33%	25%	25%	33%
Partly agree	3			50%		50%	50%	33%
Neutral	4			50%				
Partly disagree	5							
Disagree	6					25%		
Completely disagree	7							
	Score	1.00	2.00	3.50	1.33	3.50	2.25	2.00
	Fraction	0.14	0.29	0.50	0.19	0.50	0.32	0.29
Measuring scale	Interval scale							
Class	Social-political acceptance							
Dimension	Object dimension							

Table 11
Results and metadata for question 26.

(26) CCS projects need to be realized in a broader context of climate change	Scale question 26	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	7	100%		50%		25%	50%	100%
Agree	6		100%	50%	50%	75%	50%	
Partly agree	5				50%			
Neutral	4							
Partly disagree	3							
Disagree	2							
Completely disagree	1							
	Score	7.00	6.00	6.50	5.50	6.25	6.50	7.00
	Fraction	1.00	0.86	0.93	0.79	0.89	0.93	1.00
Measuring scale	Interval scale							
Class	Social-political acceptance							
Dimension	Object dimension							

knowledge. The high expectations regarding the benefits are also revealed by the large national research budget made available for CCS in the Netherlands [83].

From the perspective of the national government, finding the right level of participation for local communities which satisfies all non-local and local stakeholders is key for gaining community acceptance for CCS projects in the Netherlands. We argue, on the basis of our survey results, that the level of participation of the local communities in the decision-making process is the main stumbling block here. Firstly, actual involvement of the local community in the decision-making process is not viewed by all stakeholders as beneficial. Secondly, lower steps on the “participation ladder” [84] such as more local benefits, are also not endorsed by all stakeholders. Thirdly, there seems to be broad support for the lowest level of participation, which

is informing the local population about CCS, because most stakeholders see the unfamiliarity with CCS as the main reason for people attitude towards CCS. On the basis of our results, we recommend that it is absolutely necessary to consult the potential host communities about their views concerning a CCS project in the very early phase of the decision-making process. The benefit of this is that decision-makers can gain an actual insight in the community acceptance level, instead of assuming a certain acceptance level on the basis of nationally derived insights, as was the case in the Northern-Netherlands CCS initiative.

Our results can also be seen to fit in a wider (Dutch) context because limited social-political acceptance has also been observed in the decision-making process for wind energy as one of the key reasons for explaining the low share of wind energy in the Netherlands [46]. This would suggest that the problem is more deeply rooted than regarding CCS alone. Moreover, our investigation of the previously unexplored complicated case of the Northern-Netherlands CCS initiative provides a comprehensive insight that goes beyond the narrow view of *Not Under Our Back Yards* related issues, which are often referred to as the main issue for subsurface activities in the Netherlands. In addition, we want to point out some reservations regarding our research since we examined only the Northern Netherlands CCS initiative. Also, the way in which we interpreted the "triangle of social acceptance" and the ordinal scale for the open survey question may have limited application outside the Dutch context [85].

We conclude that the way in which responsibilities among stakeholders is arranged, i.e. the inter-subject dimension, has to improve if one strives for more acceptance for the outcome of any decision-making process for subsurface activities. Our first recommendation for improvement is that the permit procedures for

Table 12
Results and metadata for question 6.

(6) Did the national government need to apply the National Integration Scheme for the CCS project in the Northern Netherlands?	Scale question 6	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Yes	3	100%				25%	25%	33%
May be	2		100%	50%	67%	50%	50%	33%
No	1			50%	33%	25%	25%	33%
	Score	3.00	2.00	1.50	1.67	2.00	2.00	2.00
	Fraction	1.00	0.67	0.50	0.56	0.67	0.67	0.67
Measuring scale	Interval scale							
Class	Market acceptance							
Dimension	Subject dimension							

Table 13
Results and metadata for question 4.

(4) What is the need for CCS in the operations of your organization?	Scale question 4	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Very big	7							
Big	6					25%	25%	
Moderate big	5	100%						33%
Neutral	4		100%	50%				
Moderate small	3							
Small	2			50%		50%	25%	
Very small	1				100%	25%	50%	67%
	Score	5.00	4.00	3.00	1.00	2.75	2.50	2.33
	Fraction	0.71	0.57	0.43	0.14	0.39	0.36	0.33
Measuring scale	Interval scale							
Class	Market acceptance							
Dimension	Inter-subjective dimension							

Table 14
Results and metadata for question 10.

(10) Delaying the Northern Netherlands CCS project results in	Scale question 10	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
No significant change in plans	9				33%		25%	
Short term effect	8							33%
More CO_2 emission	7			50%	33%	25%	50%	33%
Higher cost for future CCS projects	6				33%	25%		
Only off shore CCS	5			50%		17%		
Delay of onshore CCS	4					17%		
Delay of developments	3		100%			17%		
Mist opportunity	2	100%						
Abandonment of CCS	1						25%	33%
	Score	2.00	3.00	6.00	7.33	5.25	6.00	5.33
	Fraction	0.22	0.33	0.67	0.81	0.58	0.67	0.59
Measuring scale	Ordinal scale							
Class	Market acceptance							
Dimension	Inter-subjective dimension							

subsurface activities, like CCS, need to be designed in accordance with the dimension of decision-making for each class of social acceptance. Secondly, we argue that this permit procedure should be based on a strategic framework which takes into account the interaction between the different classes of social acceptance. In future research, we will use these recommendations as guidelines for selecting evaluation methods and designing policy instruments which are able to deal with the issues related to social-political, market and community acceptance in an adequate way, in order to improve the decision-making process for subsurface activities, like CCS in the Netherlands.

Acknowledgments

We thank the Dutch Ministry of Economic Affairs for the funding of our research and the complete freedom for executing our research. We also want to thank all the respondents that participated in our survey. Finally, we would like to thank the two

Table 15
Results and metadata for question 22.

(22) CO_2 storage is best carried out by exploration and production because they have the required knowledge	Scale question 22	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	7			50%				67%
Agree	6	100%		50%	67%	50%		33%
Partly agree	5		100%		33%			
Neutral	4						50%	
Partly disagree	3						25%	
Disagree	2					50%		
Completely disagree	1						25%	
	Score	6.00	5.00	6.50	5.67	4.00	3.00	6.67
	Fraction	0.86	0.71	0.93	0.81	0.57	0.43	0.95
Measuring scale	Interval scale							
Class	Market acceptance							
Dimension	Inter-subjective dimension							

Table 16
Results and metadata for question 7.

(7) The CCS project in the Northern Netherlands was partly intended to gain knowledge. What knowledge has the highest value, according to your belief?	Scale question 7	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Transport	1							
Capture	2				33%			
Storage	3					25%		33%
Legal procedures	4	100%					25%	
Business model	5		100%			25%	25%	33%
Public acceptance	6			100%	67%	50%	50%	33%
	Score	4.00	5.00	6.00	4.67	5.00	5.25	4.66
	Fraction	0.67	0.83	1.00	0.78	0.83	0.88	0.78
Measuring scale	Interval scale							
Class	Market acceptance							
Dimension	Object dimension							

Table 17
Results and metadata for question 8.

(8) To what extent do you think that this knowledge can be applied to other CCS projects?	Scale question 8	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Very good	7		100%		33%	25%	50%	
Good	6	100%		100%	33%	75%	25%	33%
Moderate good	5				33%			
Neutral	4							
Moderate little	3						25%	33%
Little	2							33%
Very little	1							
	Score	6.00	7.00	6.00	5.99	6.25	5.75	3.66
	Fraction	0.86	1.00	0.86	0.86	0.89	0.82	0.52
Measuring scale	Interval scale							
Class	Market acceptance							
Dimension	Object dimension							

anonymous reviewers for their comments and suggestion. Their help is greatly appreciated. The usual disclaimer applies.

Appendix A. Survey administration

In our survey the following organization where involved (see Table 1).

As made clear in Table 1 we have a wide representation of organization involved in our survey, ranging from E&P companies to interest groups. Furthermore, in some groups we have a higher number of respondents, like regional governments. This is due to the fact that their where three province's involved in the Northern-Netherlands CCS initiative. Also for scientific or research, interest/lobby groups and other organizations their where multiple organizations involved. On the basis of the respondent that took part in our survey we have found the following professional sectors (see Table 2).

In our survey we see a high number of respondents that are related to the decision-making an research sector. This is explained by the subject of our research, namely the decision-making process of the Northern-Netherlands CCS project. Therefore we believe that the low share of the communication sector is not a problem. Finally, we found that the respondents in our survey where hardly involved

Table 18
Results and metadata for question 23.

(23) Investments in CCS may partly be at the expense of other activities of exploration and production	Scale question 23	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	7				33%		25%	
Agree	6	100%		50%	33%	25%	25%	67%
Partly agree	5			50%		25%		
Neutral	4				33%			
Partly disagree	3						25%	
Disagree	2		100%			50%	25%	33%
Completely disagree	1							
	Score	6.00	2.00	5.50	5.66	3.75	4.50	4.67
	Fraction	0.86	0.29	0.79	0.81	0.54	0.64	0.67
Measuring scale	Interval scale							
Class	Market acceptance							
Dimension	Object dimension							

Table 19
Results and metadata for question 20.

(20) The identification of suitable sites for CO_2 storage by the national government resulted in negative feelings among the citizens	Scale question 20	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	1						50%	33%
Agree	2				50%		25%	
Partly agree	3		100%	50%	50%	50%	25%	67%
Neutral	4	100%				25%		
Partly disagree	5			50%		25%		
Disagree	6							
Completely disagree	7							
	Score	4.00	3.00	4.00	2.50	3.75	1.75	2.33
	Fraction	0.57	0.43	0.57	0.36	0.54	0.25	0.33
Measuring scale	Interval scale							
Class	Community acceptance							
Dimension	Subject dimension							

Table 20
Results and metadata for question 19.

(19) Increased participation of citizens would have led to the realization of the CCS project in the Northern Netherlands	Scale question 19	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	7							
Agree	6						25%	33%
Partly agree	5			50%	67%	75%	25%	67%
Neutral	4		100%	50%	33%	25%	50%	
Partly disagree	3	100%						
Disagree	2							
Completely disagree	1							
	Score	3.00	4.00	4.50	4.67	4.75	4.75	5.33
	Fraction	0.43	0.57	0.64	0.67	0.68	0.68	0.76
Measuring scale	Interval scale							
Class	Community acceptance							
Dimension	Subject dimension							

Table 21
Results and metadata for question 16.

(16) What do you think was the main reason for this attitude?	Scale question 16	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Externally imposed requirement	5				25%	29%		
Sobriety	4				25%	14%		33%
Familiar with other activities in the subsurface	3	50%	100%			14%	20%	
CCS and energy sector were seen as an opportunity	2					14%	40%	
Unfamiliar with CSS	1	50%		100%	50%	29%	40%	67%
	Score	2.00	3.00	1.00	2.75	3.00	1.80	2.00
	Fraction	0.40	0.60	0.20	0.55	0.60	0.36	0.40
Measuring scale	Ordinal scale							
Class	Community acceptance							
Dimension	Inter-subjective dimension							

Table 22
Results and metadata for question 17.

(17) Which statement do you think connects the best with the views of the citizens in relation to the CCS project in the Northern Netherlands at the end of the project	Scale question 17	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
CCS is unnecessary and expensive	5	100%				25%		33%
CO_2 storage is not 100% save	4			50%	33%	25%	25%	
I know too little about CCS to make a judgment call	3				33%			
CO_2 storage is fine as long as it is not here	2							33%
First they get the gas and then they dump their trash	1		100%	50%	33%	50%	75%	33%
	Score	5.00	1.00	2.50	2.66	2.75	1.75	2.66
	Fraction	1.00	0.20	0.50	0.53	0.55	0.35	0.53
Measuring scale	Ordinal scale							
Class	Community acceptance							
Dimension	Inter-subjective dimension							

Table 23
Results and metadata for question 18.

(18) In your opinion, to which extend do the attitudes towards CCS differ between the Northerners and the rest of the Netherlands	Scale question 18	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Almost no difference	1			100%	25%	25%	33%	67%
The North is more sensitive	2	100%	100%		75%	75%	33%	33%
The North is more positive	3						33%	
	Score	2.00	2.00	1.00	1.75	1.75	2.00	1.33
	Fraction	0.67	0.67	0.33	0.58	0.58	0.67	0.44
Measuring scale	Ordinal scale							
Class	Community acceptance							
Dimension	Inter-subjective dimension							

Table 24
Results and metadata for question 15.

(15) What was to your opinion, the attitude of citizens towards CCS in the Northern Netherlands at the start of the project in 2009	Scale question 15	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Very positive	7							
Positive	6							
Moderately positive	5					50%	25%	33%
Neutral	4	100%	100%	50%	67%		75%	67%
Moderately negative	3			50%	33%	50%		
Negative	2							
Very negative	1							
	Score	4.00	4.00	3.50	3.67	4.00	4.25	4.33
	Fraction	0.57	0.57	0.50	0.52	0.57	0.61	0.62
Measuring scale	Interval scale							
Class	Community acceptance							
Dimension	Object dimension							

in the host communities that would be affected by the Northern-Netherlands CCS initiative (see Table 3).

Table 3 shows that the lobby/interest groups where the most involved organization. On the other hand national government shows the lowest level of involvement in the host communities. This was expected, because of the nature of the organizations, the national government is located in The Hague and the interest and lobby groups where located in the Northern-Netherlands, like the environmental and Nature Federation of Drenthe (one of Northern provinces).

Appendix B. Survey results

B.1. Survey questions

Our survey consisted of 28 questions, which had open and closed question. The open questions are ranked on an ordinal scale and the closed questions are ranked on a interval scale. In this appendix, the corresponding categories of social acceptance are matched with the dimension of decision-making process and

Table 25
Results and metadata for question 24.

(24) The Barendrecht CCS project was decisive for the Northern Netherlands because of the precedent: no CCS without local support	Scale question 24	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	1	100%		50%	33%			
Agree	2		100%		33%	75%	50%	
Partly agree	3			50%				67%
Neutral	4				33%			
Partly disagree	5					25%	25%	33%
Disagree	6						25%	
Completely disagree	7							
	Score	1.00	2.00	2.00	2.33	2.75	3.75	3.67
	Fraction	0.14	0.29	0.29	0.33	0.39	0.54	0.52
Measuring scale	Interval scale							
Class	Community acceptance							
Dimension	Object dimension							

Table 26
Results and metadata for question 27.

(27) The Not Under My Back Yard (NUMBY) effect is partly responsible for the outcome of the CCS project in the Northern Netherlands	Scale question 27	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	1			50%			25%	
Agree	2					100%	25%	33%
Partly agree	3	100%	100%	50%	67%		25%	67%
Neutral	4							
Partly disagree	5				33%		25%	
Disagree	6							
Completely disagree	7							
	Score	3.00	3.00	2.00	3.67	2.00	2.75	2.67
	Fraction	0.43	0.43	0.29	0.52	0.29	0.39	0.38
Measuring scale	Interval scale							
Class	Community acceptance							
Dimension	Object dimension							

Table 27
Results and metadata for question 28.

(28) Within the CCS project in the Northern Netherlands there was too little attention for local positive benefit	Scale question 28	E&P companies	Power companies	National government	Regional government	Science or research institution	Interest group	Other groups
Completely agree	7	100%			67%	50%		33%
Agree	6		100%			50%	75%	67%
Partly agree	5							
Neutral	4			100%	33%		25%	
Partly disagree	3							
Disagree	2							
Completely disagree	1							
	Score	7.00	6.00	4.00	6.00	6.50	5.50	6.33
	Fraction	1.00	0.86	0.57	0.86	0.93	0.79	0.90
Measuring scale	Interval scale							
Class	Community acceptance							
Dimension	Object dimension							

the corresponding survey questions. The survey questions are arranged according to the classes of social acceptance.

B.2. Social-political acceptance

See Tables 4–11.

B.3. market acceptance

See Tables 12–18.

B.4. Community acceptance

See Tables 19–27.

References

[1] Ministry of Economic Affairs, Agriculture and Innovation. Informatieblad Ondergrondse CO_2-opslag Noord-Nederland. The Hague.
[2] Pieterburen Tegengas. Available from ⟨http://pieterburen-tegengas.nl/⟩; 2012 [accessed 09.04.12].
[3] Gasalarm2. Bergen wil steun bewoners tegen gasopslag. Available from ⟨http://www.gasalarm2.nl/bergen-wil-steun-bewoners-tegen-gasopslag⟩; 2011 [accessed 05.05.12].
[4] Dütschke E. What drives local public acceptance—comparing two cases from Germany. Energy Proc 2011;4:6234–40.
[5] Roberts T, Mander S. Assessing public perceptions of CCS: benefits, challenges and methods. Energy Proc 2011;4:6307–14.
[6] Ekopolitan CCS. Denmark stops the onshore storage project at the Vattenfall Nordjylland Coal Power station. Ekopolitan; 2011.
[7] Koornneef J, Faaij A, Turkenburg W. The screening and scoping of environmental impact assessment and strategic environmental assessment of carbon capture and storage in the Netherlands. Environ Impact Assess Rev 2008;28:392–414.
[8] de Roo G, Porter G. Fuzzy planning: the role of actors in a fuzzy governance environment. Cornwall: Ashgate Publishing, Ltd; 2007.
[9] Hage J. Theories of organizations: form, process and transformation. Newport: John Wiley & Sons; 1980.
[10] Ministry of Economic Affairs, Agriculture and Innovation. Energy rapport 2011. The Hague. p. 62.
[11] Seebregts AJ, Volkers CH. Monitoring Dutch power stations 2000–2004, ECN-C-05-090. Petten.
[12] Groen Front. Geplande kolencentrales in Nederland. Available from ⟨http://www.wijstoppensteenkool.nl/?page_id=159⟩; 2012 [accessed 09.05.12].
[13] Core Team CCS Northern-Netherlands. Carbon capture and storage: action plan Northern-Netherlands.
[14] Province of Groningen. Licence, Environmental Law given to RWE Power AG, Essen Power plant (2×800 Mwe) pulverized coal and biomass. Eemshaven; 2007.
[15] Province of Groningen. Establishment permit, under the environmental management act; granted to Nuon Power 1 BV Project for the establishment and operation of a multi-fuel power plant in the Eemshaven; 2009.
[16] Borg Foundation. Three-day evaluation meeting on the decision-making process for the Northern-Netherlands CCS project; 2011.
[17] NLOG. NLOG Fields 1 December 2011.kml. Available from ⟨http://www.nlog.nl/nl/pubs/maps/other_maps/other_maps.html⟩; 2011 [accessed 09.05.12].
[18] NLOG. Field development plan. Available from ⟨http://www.nlog.nl/nl/procs/procedures_plans.html⟩; 2012 [accessed 02.14.12].
[19] Breunese J, Remmelts G, van der Velde R, Mieog J. Potential for CO_2 storage in depleted gas fields at the Dutch Continental Shelf Phase 1: technical assessment, 2008-U-R0674/A. The Hague.
[20] Aha!. Polls states of Drenthe 2011 elections survey 3 – week 5. Assen.
[21] CO2NTRAMINE. Mission, vision and core values. Available from ⟨http://www.co2ntramine.nl/over-ons/visie-en-missie/⟩; 2012 [accessed 01.19.12].
[22] Verhagen M. Canceling of the Barendrecht CCS project[tv]. Available from ⟨http://youtu.be/8pPkyxlbZvY⟩.
[23] Mannarini T. Six factors fostering protest: predicting participation in locally unwanted land uses movements. Polit Psychol 2009;30:895–920.
[24] Environmental Federation of Groningen. Government blackmails CO_2 storage debate. Available from ⟨http://www.nmfgroningen.nl/default.aspx?page=3960⟩; 2011 [accessed 09.04.12].
[25] Huijts NMA, Molin EJE, Steg L. Psychological factors influencing sustainable energy technology acceptance: a review-based comprehensive framework. Renew Sustain Energy Rev 2012;16:525–31.
[26] Feenstra Y, Mikunda T, Brunsting S. What happened in Barendrecht? Case study on the planned onshore carbon dioxide storage in Barendrecht, the Netherlands. Energy Research Centre of the Netherlands, Petten.
[27] Wüstenhagen R, Wolsink M, Bürer MJ. Social acceptance of renewable energy innovation: an introduction to the concept. Energy Policy 2007;35:2683–91.
[28] Mikunda T, Feenstra Y. Effective communication strategies to engage the public and stakeholders around CCS projects: a review of country experiences, ECN-O-10-039. Petten.
[29] Anderson C, Schirmer J, Abjorensen N. Exploring CCS community acceptance and public participation from a human and social capital perspective. Mitigation Adapt Strat Global Change 2011.
[30] Arabatzis G, Myronidis D. Contribution of SHP Stations to the development of an area and their social acceptance. Renew Sustain Energy Rev 2011;15:3909–17.
[31] Tampakis S, Tsantopoulos G, Arabatzis G, Rerras I. Citizens' views on various forms of energy and their contribution to the environment. Renew Sustain Energy Rev 2013;20:473–82.
[32] Lopez AP. Lay perceptions of nuclear fusion: multiple modes of understanding. Sci Public Policy 2008;35:95–105.
[33] North D. Institutions, institutional change and economic performance. 1st ed.. St. Louis: Cambridge University Press/Washington University; 1990.
[34] Stephens JC. Assessing innovation in emerging energy technologies: socio-technical dynamics of carbon capture and storage (CCS) and enhanced geothermal systems (EGS) in the USA. Energy Policy 2010;38:2020–31.
[35] Loorbach DA. Transition management: new mode of governance for sustainable development. 1st ed.. Rotterdam: Dutch Research Institute for Transitions; 2007.
[36] Ishii A, Langhelle O. Toward policy integration: assessing carbon capture and storage policies in Japan and Norway. Global Environ Change 2011;21:358–67.
[37] Carley S, Krause R, Warren D, Rupp J, Graham J. Early public impressions of terrestrial carbon capture and storage in a coal-intensive state. Environ Sci Technol 2012;46:7086–93.
[38] Metz B, Davidson O, de Coninck CH, Loos M, Meyer AL. IPCC special report on carbon dioxide capture and storage. Prepared by working group III of the intergovernmental panel on climate change. Cambridge, United Kingdom/New York, NY, USA.
[39] NETL. Carbon capture and storage (CCS) database-version 3. Available from ⟨http://www.netl.doe.gov/technologies/carbon_seq/global/database/index.html⟩; 2011 [accessed 01.07.11].
[40] Huijts NMA, Midden CJH, Meijnders AL. Social acceptance of carbon dioxide storage. Energy Policy 2007;35:2780–9.
[41] De argumenten fabriek. Argument map CO_2 capture and storage in the Netherlands. Available from ⟨http://www.co2-cato.org/publications/publications/argumenten-map-english⟩; 2010 [accessed 05.04.12].
[42] Paukovic M, Brunsting S, de Best-Waldhober M. The Dutch general public's opinion on CCS and energy transition: development in awareness, knowledge, beliefs and opinions related to information and media coverage, CATO2-WP5.3-D02a. p. 1–189.
[43] Huijts N. Social acceptance of carbon dioxide storage. Energy Policy 2007;35:2780.
[44] Kuijper M. Public acceptance challenges for onshore CO_2 storage in Barendrecht. Energy Proc 2011;4:6226–33.
[45] Greenpeace. CO_2-dumping Barendrecht staat schone energie in de weg. Available from ⟨http://www.greenpeace.nl/news/co2-dumping-barendrecht-is-eno/⟩; 2009 [accessed 03.09.12].
[46] Breukers S, Wolsink M. Wind energy policies in the Netherlands: institutional capacity-building for ecological modernisation. Environ Polit 2007;16:92–112.
[47] Ministry of Economic Affairs, Agriculture and Innovation. Mining act (Mijnbouwwet), 2012-01-18-2012. The Hague.
[48] Gasunie EBN. CO_2 transport and storage strategies. Utrecht.
[49] Bowen F. Carbon capture and storage as a corporate technology strategy challenge. Energy Policy 2011;39:2256–64.
[50] Stern NH. The economics of climate change: the stern review. 1st ed.. Cambridge, United Kingdom/New York, NY, USA: Cambridge University Press; 2007.
[51] NLOG. Natural gas reserves and future domestic supply, measurement moment 1 January 2011. Utrecht.
[52] AMESCO Stuurgroep: NAM, SEQ, Nogepa, Essent, Electrabel, Eneco, Provincie Groningen, Friesland, Drenthe, Zuid Holland, Ministerie van VROM, Staatstoezicht op de Mijnen, AMESO. Algemene Milieu Effecten Studie CO_2 Opslag: final rapport; 2007.
[53] Bolourinejad P, Herber MA. Experimental and modeling study of salt precipitation during injection of CO_2 contaminated with H_2S into depleted gas fields in Northeast Netherlands. Society of Petroleum Engineers; 2013.
[54] McKinsey. Large scale roll out scenarios for CCS in the Netherlands: 2020–2050. Final report for the Ministry of Economic Affairs and the Ministry of Housing, Spatial Planning and the Environment, Amsterdam.
[55] Li S, Zhang X, Gao L, Jin H. Learning rates and future cost curves for fossil fuel energy systems with CO_2 capture: methodology and case studies. Appl Energy 2012;93:348–56.
[56] Europe's Energy Portal. EU emissions allowances; 2013 [accessed 09.09.13].
[57] Rotterdam Climate Initiative. CO_2 capture and storage in Rotterdam. A network approach. Rotterdam.
[58] FutureGen Alliance. FutureGen 2.0 project. Available from ⟨http://www.futuregenalliance.org/futuregen-2-0-project/⟩; 2012 [accessed 03.04.12].
[59] European Union. Laying down criteria and measures for the financing of commercial demonstration projects that aim at the environmentally safe capture and geological storage of CO_2 as well as demonstration projects of innovative renewable energy technologies under the scheme for greenhouse gas emission allowance trading within the Community established by Directive 2003/87/EC of the European Parliament and of the Council; 2010 [article 12].

[60] Wolsink M. Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. Renew Energy 2000;21:49–64.
[61] Wolsink M. Planning of renewables schemes: deliberative and fair decision-making on landscape issues instead of reproachful accusations of non-cooperation. Renew Sustain Energy Rev 2007;11:2692–704.
[62] Luloff AE. NIMBY and the hazardous and toxic waste siting dilemma: the need for concept clarification. Soci Nat Resourc 1998;11:81–9.
[63] Peil. CO_2 storage[tv]. Available from 〈http://www.omroepwnl.nl/video/fragment/CO2-opslag_32304#〉 [retrieved date 09.05.12].
[64] Devine-Wright P. Rethinking NIMBYism: the role of place attachment and place identity in explaining place-protective action. J Community Appl Soc Psychol 2009;19:426–41.
[65] Sherif CW. Attitude and attitude change: the social judgment-involvement approach. 1st ed.. Westport, CT: Greenwood Press; 1981.
[66] Bradburry J, Greenberg S, Wade ES. Communicating the risks of CCS. Global CCS Institute; 2011.
[67] Shell EIA. Underground storage of CO_2 in Barendrecht, EP200809225671. The Hague.
[68] Vorkinn M. Environmental concern in a local context. Environ Behav 2001;33:249–63.
[69] ter Mors E. Dealing with information about complex issues. The role of source perception. Leiden: Kurt Lewin Instituut; 2009.
[70] Daamen D, Terwel B, ter Mors E. Wat weten en vinden Barendrechters van het CO_2 opslag plan en van de voorlichting en besluitvorming over dit plan? Resultaten van een enquête in mei 2010 onder ruim 800 inwoners. Leiden.
[71] Torvanger A, Meadowcroft J. The political economy of technology support: making decisions about carbon capture and storage and low carbon energy technologies. Global Environ Change 2011;21:303–12.
[72] Ishii A, Langhelle O. Toward policy integration: assessing carbon capture and storage policies in Japan and Norway. Global Environ Change 2011;21:358–67.
[73] de Coninck H, Bäckstrand K. An international relations perspective on the global politics of carbon dioxide capture and storage. Global Environ Change 2011;21:368–78.
[74] Hund G, Greenberg SE, Dual-track CCS. stakeholder engagement: lessons learned from FutureGen in Illinois. Energy Proc 2011;4:6218–25.
[75] Ribeiro F, Ferreira P, Araújo M. The inclusion of social aspects in power planning. Renew Sustain Energy Rev 2011;15:4361–9.
[76] Shackley S, McLachlan C, Gough C. The public perception of carbon dioxide capture and storage in the UK: results from focus groups and a survey. Clim Policy 2005;4:377–98.
[77] Likert R. A technique for the measurement of attitudes. Archives of Psychology; 1932.
[78] Göb R, McCollin C, Ramalhoto MF. Ordinal methodology in the analysis of Likert scales. Qual Quant 2007;41:601–26.
[79] Adams EW, Fagot RF, Robinson RE. A theory of appropriate statistics. Psychometrika 1965;30:99–127.
[80] Ministry of Infrastructure and Environment. Spatial planning act. The Hague; 2012.
[81] Fleishman LA, De Bruin WB, Morgan MG. Informed public preferences for electricity portfolios with CCS and other low-carbon technologies. Risk Anal 2010;30:1399–410.
[82] Hart S, Milstein M. Creating sustainable value. Acad Manage Exec 2003;17:56–69.
[83] Tjernshaugen A. Political commitment to CO_2 capture and storage: evidence from RD&D budgets. Mitigation Adapt Strat Global Change 2006;13:1–21.
[84] Arnstein SR. A ladder of citizen participation. J Am Inst Plann 1969;35:216–24.
[85] Yin RK. Case study research: design and methods. 4th ed.. Thousand Oaks, CA: Sage; 2009.